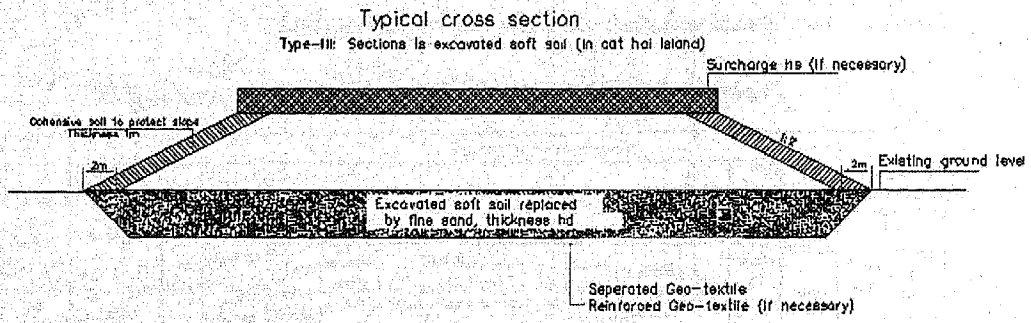
2) Replacement



Source: F/S Report (July 2009)

Figure 2.5-16 Typical Cross Section of Soft Ground Treatment (Replacement)

2.5.8. Major Work Quantities

Major work quantities are summarized in Tables 2.5-27~35.

Table 2.5-28 Quantities for Temporary Work

	Item	UNIT	Quantites	note
TEMP Facility	Yard and Temporary Facility	LS	1.0	
	Temporary Road	m^3	266,768.0	
	Temporary Jetty	m2	27,879.0	

Source: Study Team

Table 2.5-29 Quantities for Tan Vu Interchange

		Work Item	unit	Quantites	notes
TAN VU INTERCHANGE	EMBANKMENT	Excavetion of organic soil	m^3	38,797.7	
		Embankment of sand, K=0.95	m^3	216,423.0	include K=0.98
		Embankment of Clay (Slope Protection)	m^3	42,784.5	
		Sodding (Slope Protection)	m^3	42,784.5	
	SOFT SOIL TREATMENT	Geotextile Filter Fabric (non-woven 12kN/m)	m^2	190,356.2	
		Sand Blancket (medium sand)	m^3	145,959.0	
		Sand Drain (D400)	m	758,248.4	
		Embankment of sand for compensation	m^3	209,678.0	
		Removal of surcharge	m^3	76,882.3	
	PAVEMENT	Pavement areas	m^2	42,935.7	
		Geotextile Filter Fabric (non-woven, 25kn/m)	m^2	45,776.1	
	TRAFFIC SAFETY	Guide Posts	each	220.0	
		Area Reflection Pavement Marking	each	2,293.3	
		Guardrail	m	946.9	
		Reflectorized Pavement Stud	each	524.0	
		Concrete curb	m	1,700.3	
		Planting	each	611.0	
		Lighting Pole-Single Arms	pole	69.0	

Source: Study Team

Table 2.5-30 Quantities for Road Work at Hai An Side

Work Item			unit	Quantites	notes
HAI AN side ROAD WORK	EMBANK MENT	Excavetion of organic soil	m^3	90,781.0	include nomal soil
		Embankment of sand, K=0.95	m^3	420,923.0	include K=0.98
		Embankment of Clay (Slope Protection)	m^3	46,708.3	
		Sodding (Slope Protection)	m^3	46,708.3	
	APPROACH ROAD (Soft Soil Treatment)	Geotextile Filter Fabric (non-woven)	m^2	352,569.0	include woven
		Sand Blancket (medium sand)	m^3	266,363.9	
		Sand Drain (D400)	m	1,798,841.4	
		Embankment of sand for compensation	m^3	431,280.0	
		Removal of surcharge	m^3	179,569.8	
	PAVE MENT	Fine Asphalt Concrete -5cm and 7cm	m^2	72,421.8	
		Aggregate Base and Subbase	m^3	58,585.0	
		Geotextile Filter Fabric (non-woven, 25kn/m)	m^2	105,021.1	
	TRAFFIC SAFETY	Guide Posts	each	823.0	
		Area Reflection Pavement Marking	each	5,738.4	
		Guardrail	m	748.8	
		Reflectorized Pavement Stud	each	1,099.0	
		Concrete curb	m	8,208.1	
		Planting	each	1,369.0	
		Lighting Pole-Single Arms	pole	216.0	
	Culvert	RC Pipe Culvert-D2.0m	m	43.0	
		RC Box Culvert-3m*3m(Km0+9)	m	46.6	
		RC Box Culvert-3m*4m*4m(Km0+9)	m	29.1	
	Cam Box Culvert	Concrete of box culvert, wall 28MPa	m^3	1,912.0	
		Reinforcement of box culvert, wall	ton	315.8	
		Lean Concrete	m^3	144.0	
	Cam Box Culvert	Billing Stone	m^3	119.0	
		Masonry	m^3	44.0	
		Concrete of approach slab, 28MPa	m^3	38.0	
		Reinforcement of approach slab	ton	4.7	
		Pavement(Fine,asphalt concrete-7cm)	m^2	1,360.0	
		Water proofing layer	m^2	1,360.0	
		Embankment of drainage material	m^3	2,120.0	
		Excavation of soil for foundation pit	m^3	1,770.0	
		Drive test pile 35*35cm (2piles)	m	80.0	
		Drive test pile 35*35cm	m	6,400.0	

Source: Study Team

Table 2.5-31 Quantities for Approach Road and Retaining Wall at Hai An Side

Work Item			unit	Quantites	notes
APPROACH ROAD & RETAINING WALL HAI AN SIDE	EMBANK MENT	Embankment of sand, K=0.95	m^3	58,320.0	include K=0.98
		Geotextile Fillter Fabric (non-woven, 25kN/m)	m^2	12,970.0	
		Pavement	m^2	12,592.0	
		Sodding (Slope Protection)	m^2	950.0	
	RETAINING WALL	Concrete of Retainingwall, 28MPa	m^3	22,012.0	
		Reinforcement of retaining wall	ton	1,761.0	
		Lean Concrete	m^3	1,269.0	
		RC Piles 35*35cm	m	81,198.0	
		Metal Railing	m	950.0	
		Cast iron drain pipe D150	m	633.0	

Source: Study Team

Table 2.5-32 Quantities for Road Work for Approach Bridge

Item			unit	Quantites	Amount (VND)
Hai An Side APPROACH BRIDGE	SUPER STRUCTURE	Box girder 45MPa for Box Girder bridge	m^3	36,331.0	Segment Method
		High Strength cable, transverse	ton	194.0	
		Concrete of deck, curb 28MPa	m^3	2,863.0	C40
		Reinforcement of deck, curb	ton	286.0	SD490
		Asphalt concrete of bridge deck	m^2	49,772.0	
		Metal Railing	m	7,963.0	
		Bearing	each	248.0	
		Water proofing layer	m^2	49,772.0	
		Bridge name sign	each	1.0	
		Expansion Joint	m	95.0	
		Lighting Pole -Single Arms	each	199.0	
		Cast iron drain pipe D150	set	995.0	
	SUBSTRUCTURE	Concrete of Abutment, pier, 28MPa (Under W	m^3	17,819.0	C40
		Reinforcement of abutment, pier	ton	1,604.0	SD490
		Steel Pipe Pile	ton	7,523.0	
		Foundation Excavation	m^3	21,424.0	
		Embankment of drainage material	m^3	9,456.0	
		Sheet Pile	ton	6,801.0	
		Driving and Pulling steel sheet pile	m	64,763.0	
		timpering(manifacturing,Installation,Removal)	ton	1,360.0	

Source: Study Team

Table 2.5-33 Quantities for Main Bridge

Work Item			unit	Quantites	notes
MAIN BRIDGE	SUPER STRUCTURE	Box girder 45MPa for Box Girder bridge	m^3	9,714.0	C40
		High Strength cable, transverse	ton	55.0	
		Concrete of deck, curb 28MPa	m^3	678.0	
		Reinforcement of deck, curb	ton	67.0	SD490
		Asphalt concrete of bridge deck	m^2	11,775.0	
		Metal Railing	m	1,884.0	
		Bearing 9000kN	each	4.0	
		Bearing 5000kN	each	24.0	
		Water proofing layer	m^2	11,775.0	
		Expansion Joint	m	42.0	
		Lighting Pole -Single Arms	each	47.0	
		Naigation light	set	1.0	
		Cast iron drain pipe D150	set	237.0	
	SUBSTRUCTURE	Concrete of Abutment, pier, 28MPa (Under W	m^3	12,447.0	C40
		Reinforcement of abutment, pier	ton	1,120.0	SD490
		Steel Pipe Sheet Pile(Exteria)	ton	4,725.7	SKY400
		Steel Pipe Sheet Pile(Bulk Head)	ton	1,575.0	SKY400
		Steel Pipe Pile(End Pier)	ton	1,328.0	SKK400
		Reinforcing Bar Stud SM490A-SD	ton	7.8	
		Bottom slab concrete	m^3	2,592.0	Tremie concrete
		PDA test on 1.2m Dia. Steel Pipe Sheet Pile	Nos.	3.0	
		Mortar Filling to Steel Pipe Joint	ton	68.0	
		Foundation Excavation	m^3	3,513.0	
		Embankment of drainage material	m^3	2,851.0	
		Structurel Excavation Inside Piles and joint pi	m^3	10,368.0	
		Sheet Pile(End Pier)	ton	908.0	End Pier
		Driving and Pulling steel sheet pile	m	8,640.0	
		timpering (manifacturing, Installation,Removal)	ton	182.0	

Source: Study Team

Table 2.5-34 Quantities for Approach Bridge at Cat Hai Side

Work Item			unit	Quantites	notes
Cat Hai Side APPROACH BRIDGE	SUPER STRUCTURE	Box girder 45MPa for Box Girder bridge	m^3	4,731.0	Segment Method
		High Strength cable, transverse	ton	25.0	
		Concrete of deck, curb 28MPa	m^3	373.0	
		Reinforcement of deck, curb	ton	37.0	SD40
		Asphalt concrete of bridge deck	m^2	6,490.0	
		Metal Railing	m	1,038.0	
		Bearing	each	32.0	
		Water proofing layer	m^2	6,490.0	
		Bridge name sign	each	1.0	
		Expansion Joint	m	14.0	
		Lighting Pole -Single Arms	each	26.0	
		Cast iron drain pipe D150	set	130.0	
	SUBSTRUCTURE	Concrete of Abutment, pier, 28MPa (Under W)	m^3	2,713.0	C40
		Reinforcement of abutment, pier	ton	244.0	SD40
		Steel Pipe Pile	ton	1,197.0	
		Foundation Excavation	m^3	3,161.0	
		Embankment of drainage material	m^3	1,374.0	
		Sheet Pile	ton	903.0	
		Driving and Pulling steel sheet pile	m	8,603.0	
		Timpering(manifacturing,Installation,Removal)	ton	181.0	

Source: Study Team

Table 2.5-35 Quantities for Approach Road and Retaining Wall at Cat Hai Side

Work Item			unit	Quantites	notes
APPROACH ROAD & RETAINING WALL CAT HAI SIDE	EMBANK MENT	Embankment of sand, K=0.95	m^3	17,617.0	
		Geotextile Fillter Fabric (non-woven, 25kN/m)	m^2	5,149.0	
		Pavement	m^2	4,999.0	
		Sodding (Slope Protection)	m^2	377.0	
	RETAINING WALL	Concrete of Retainingwall, 28MPa	m^3	8,492.0	
		Reinforcement of retaining wall	ton	679.3	
		Lean Concrete	m^3	504.0	
		RC Piles 35*35cm	m	32,234.0	
		Metal Railing	m	377.0	
		Cast iron drain pipe D150	m	251.0	

Source: Study Team

Table 2.5-36 Quantities for Road Work at Cat Hai Side

Work Item			unit	Quantites	notes
CAT HAI side RORD WORK	EMBANK MENT	Excavetion of organic soil	m^3	136,972.0	Include normal soil
		Embankment of sand, K=0.95	m^3	604,139.0	Include K=0.98
		Embankment of Clay (Slope Protection)	m^3	82,125.5	
		Sodding (Slope Protection)	m^3	82,125.5	
	APPROACH ROAD (SOFT SOIL TREATMENT)	Excavation of unsuitable soil	m^3	107,107.7	
		Embankment of sand, K=0.95	m^3	107,107.7	
		Geotextile Filter Fabric (non-woven)	m^2	599,400.0	Include woven type
		Sand Blancket (medium sand)	m^3	188,786.2	
		Sand Drain (D400)	m	1,313,630.9	
		Embankment of sand for compensation	m^3	344,704.0	
		Removal of surcharge	m^3	171,021.8	
	PAVE MENT	Fine Asphalt Concrete -5cm and 7cm	m^2	135,847.3	
		Aggregate Base and Subbase	m^3	109,893.0	
		Geotextile Filter Fabric (non-woven, 25kn/m)	m^2	196,206.0	
	TRAFFIC SAFETY	Guide Posts	each	1,380.0	
		Area Reflection Pavement Marking	each	8,598.6	
		Guardrail	m	480.0	
		Reflectorized Pavement Stud	each	1,842.0	
		Concrete curb	m	13,779.7	
		Planting	each	2,298.0	
		Lighting Pole-Single Arms	pole	361.0	
	CULVERT	RC Pipe Culvert-D1.25m	m	258.0	
		RC Box Culvert-2m*4m*3m(Km10+818)	m	31.5	
		RC Box Culvert-1.5*3m(Km14+669)	m	31.6	
		RC Box Culvert-3m*3m(Km 14+926)	m	31.8	
		RC Box Culvert-3m*4m*4m (Km 15+150)	m	31.9	

Source: Study Team

2.6. Preliminary Construction Planning

Construction period was changed to 32 months based on discussions between JICA and MOT. Updated construction plan is presented in Appendix-10.

In this section, the result of the Study concerning the construction period of 30 months required in the TOR of the Study, is presented.

2.6.1. Review of the F/S

In the F/S, the construction period is estimated as 36 months. In order to meet the scheduled opening of the road in 2014, shortening to 30 months as required in the TOR of this Study, following items in the construction plan, must be reconsidered:

- Shorten the construction period to open the port in time.
- Ensure construction safety during typhoon season.

Based on the above-mentioned points of view, and the result of the survey on construction method, it can be said that the following innovative methods and technologies are needed.

(1) ***Shorten the Construction Period***

In this project, the road on the Hai An side is about 4.5 km long, the bridge is about 5.4 km long, and the road on the Cat Hai side is about 5.9 km long. Among these, the critical item to determine the construction period of the project is the construction of the bridge.

In order to shorten the construction period of the bridge to be within 30 months, the following solutions are recommended:

1) Selection of Construction Method for Less Construction Period considering Safety

For Approach Bridge

Adopt **Steel Pile Method.** The construction method for sheet pile is simple and takes much lesser time than that of cast-in-place pile method. This method is less risky in terms of driving in mud, collapse of borehole, rebar cage installation and mixture of impurities to the concrete. Hence, delayed project progress would be unlikely. It is noted that this construction method causes significant noise impacts. However, since the construction site is offshore and far from the residential zone, such impact is not a problem.

For Main Bridge

At the foundation of the main bridge, due to the deep level of water, large scale construction of temporary cofferdam is necessary. Thus, **the steel pipe well foundation** is combined with temporary cofferdam. Because it is not necessary to construct the temporary cofferdam separately, it will take much less time to execute said works. Moreover, the steel pipe well foundation method is not only much faster but also safer for offshore construction (See Section below for construction safety).

2) Superstructure Construction

The super-T girder type superstructure selected in the F/S is supposed to be constructed through the precast method. With reference to other projects that adopt super-T girder types, such method does not seem to guarantee highly productive construction progress.

Especially for the above structure in this project, large scale construction for the bridge span installation is involved. Thus, this requires systemized construction in order to realize cost reduction and time savings.

(2) Construction Safety of the Project

The depth of sea water below the bridge is over 10 m, and it significantly varies due to tidal effects. In addition, during the typhoon season, height of waves could be nearly 10 m. Hence, in order to build the foundation of bridge, it is necessary to construct temporary cofferdam.

In the F/S, except the point near the mainland, all pier locations are planned to be installed with temporary single steel sheet pile cofferdam. There would be no problem at shallow sea water area, however, it is strongly recommended to change the construction method at deep water section.

Especially from piers P109 to P116 section, surrounding water depth is exceeding 10 m. In such condition, standard construction method is not applicable and special attention shall be paid for considering construction safety.

At such depth, temporary cofferdam shall be constructed by the double steel sheet pile method (temporary) or a steel pipe sheet pile method (permanent) in order to ensure construction safety. It is proposed to apply the **steel pipe well foundation method** as the temporary cofferdam for piers P109 to P116, section as shown in Figure 2.6-1.

In particular, for the foundation of the main bridge, steel pile well with temporary cofferdam method is preferable from the view point of construction safety and shortening of construction period.

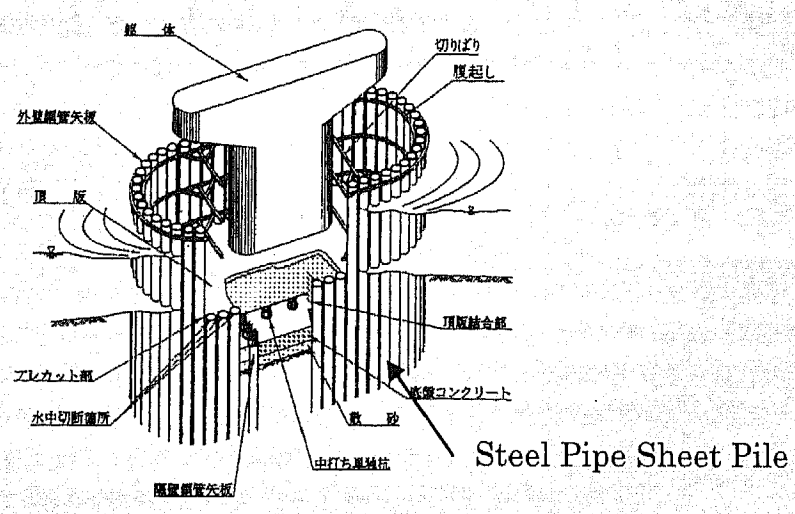


Figure 2.6-1 Schematic View of Steel Pipe Well Foundation

In case the steel pipe well foundation is not adopted, temporary cofferdam by double sheet pile method would be applied as shown in Figure 2.6-2. This temporary method is not recommended from technical viewpoint of construction safety. In addition, this method surely involves significantly longer construction period than the above.

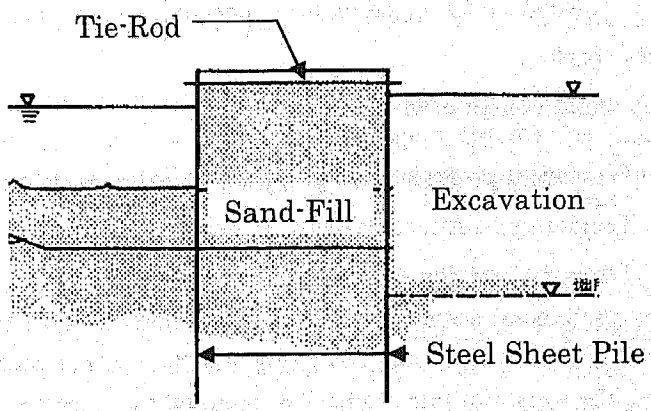


Figure 2.6-2Cofferdam with double steel sheet Pile

(3) ***Conclusion of the Review of the F/S Construction Plan***

In order to meet the 30 months construction period as required in the Study TOR, it is necessary to shorten the construction time, while ensuring the construction safety of the project. Hence, in consideration of the application of STEP scheme, it is proposed to apply the following modifications related to the bridge works:

- Change the construction method for the bridge superstructure from super-T girder to PC segmental box girder to further ensure durability as the structure is subject to salt water damage.
- Adopt the SBS Method for the erection of the superstructure of the approach bridge to shorten the construction period.
- Use steel pile foundation for the approach bridge to shorten the construction period.
- Use steel pipe well with temporary cofferdam foundation for the main Bridge to improve construction safety and for reducing construction period.

2.6.2. Major Work Item

Quantities of the bridge works were calculated for the bridges with four lanes of 3.0 m width each. Meanwhile, updated quantities based on the 4-lane, 3.5 m width bridge scheme are indicated in Appendix-10.

(1) ***Outline of Construction Works***

The project is roughly composed by the following work items

- Temporary works
- Hai An side

- Road works including three intersections.
  - Tan Vu Intersection
  - Approach Bridge
  - Flyover Bridge
- Main Bridge
- Cat Hai side
  - Approach Bridge
  - Road works including the connecting section to the port works

1) Temporary works

Temporary works consist of the following items:

- Temporary yards (including engineers' office, contractors and labor office, etc.)
- Temporary construction roads and jetty
- Temporary staging and cofferdam

Especially, the precast segment construction method proposed for the approach bridge needs about 60,000 m^2 of area for manufacturing and storage. Furthermore, according to the current calculation, the weight of one segment is about 60 tons, and hence, it is necessary to design a temporary bridge and staging which can sustain such weight.

2) Road and Intersection

The construction items for the road and intersections are the same as those in the F/S report such as earthworks, pavement and soft ground treatment planning. Regarding the soft ground treatment, there was no further study as shown in Section 2.5.7. Several construction methods, which were proposed in the F/S, were selected, and construction costs were updated.

3) Main Bridge

The main bridge consists of a PC-box continuous girder bridge supported on V-shaped pier. The length of the bridge is as shown below. The erection method adopted is the balanced-cantilever method with the use of a traveling form. The construction method drawings are presented in Sheet No.C-04 in Appendix-1 "Drawings".

In addition, for the foundation of the main bridge, with the aim of ensuring construction safety and shortening the construction period, steel pipe well foundation is selected. The construction method drawings are presented in Sheet No.C-03 in Appendix-1 "Drawings".

4) Approach Bridge

The approach bridge has a total length of about five km, which is divided into six sections.

Table 2.6-1 Sections of Approach Bridge

Approach Bridge (1)	548.2m = 46.6m + 7×65.0m + 46.6m
Flyover Bridge (1)	226.0m (= 68.75m+83.5m+68.75m)
Approach Bridge (2)	2,133.5m = 53.5m +10×65.0m + 11×65m + 11×65.0m
Flyover Bridge (2)	226.0m (= 68.75m+83.5m+68.75m)
Approach Bridge (3)	1,300.0m = 10×65.0m + 10×65.0m
Approach Bridge (4)	519.2m = 7×65.0m + 64.2m (Main Bridge – Cat Hai island)

Regarding the erection method, the SBS method is selected considering the length of the bridge, shape of the girder section, and the geological formation.

The erection girder cannot be procured in Vietnam, and hence, must be transported from Japan. Meanwhile, installation of 800 mm diameter steel pipe requires the use of hydraulic hammer. The construction method drawings are presented in Sheet No.C-04 in Appendix-1: Drawings.

The flyover bridge consists of continuous PC-box girder supported by double V-shaped pier. The length of the bridge is shown below. The erection method to be adopted is the balanced-cantilever method utilizing traveling form. The construction method drawings are illustrated in Sheet No.C-04 in Appendix-1: Drawings.

For the foundation of the flyover bridge, the steel pile method is selected to shorten the construction period. During the construction of the foundation, piles located at the sea will be installed using pile driving hammer equipment placed on a deck barge. Meanwhile, those located onshore and near the wharf will be driven on the land using the same equipment.

(2) ***Major Work Item and Approximate Quantities***

The preliminary estimated quantities for each work item are shown in Section 2.5.8.

In the quantity taken-off, updated typical cross section for the bridge based on discussions between JICA and MOT was considered. This updated data is summarized in Appendix-10.

2.6.3. Procurement Plan

(1) ***Labor***

The labors for the project are divided into three categories:

- Japanese skilled workers
- Vietnamese skilled workers
- Common labor

Japanese skilled workers

In the project, there are some work items which are rarely carried out in Vietnam, such as cofferdams combined with steel pipe sheet pile, steel pipe foundation, sand drain work and PC box girder erection by SBS method. Therefore, it is required to designate Japanese personnel in-charge who had extensive experience on such works.

Vietnamese skilled workers

It is necessary to procure special operator, such as those for large cranes, from not only near the site, but also from within Vietnam.

Common Labor

The common labor for the work will be basically procured from Hai An District and Cat Hai District.

(2) ***Material***

Major materials to be used in this project and their potential locations are shown in the table below:

Table 2.6-2 Main Materials

Major materials	Procurement location		
	Vietnam	Japanese companies in Vietnam	Japan
Embankment sand	○		
Aggregate Base, Sub Base	○		
Sand for Sand-drain	○		
Geo-textile Filter Fabric	○		
RC square pile	○		
Asphalt	○		
Guardrail, Lighting pole, etc.	○		
Cast iron drain pipe	○		
Cement		○	
Aggregate for concrete	○		
Sand for concrete	○		
Reinforcing Bar		○	
High strength cable		○	
Steel pipe pile		(○)	○
Steel pipe sheet pile			○
Bearing		○	
Expansion joint		○	

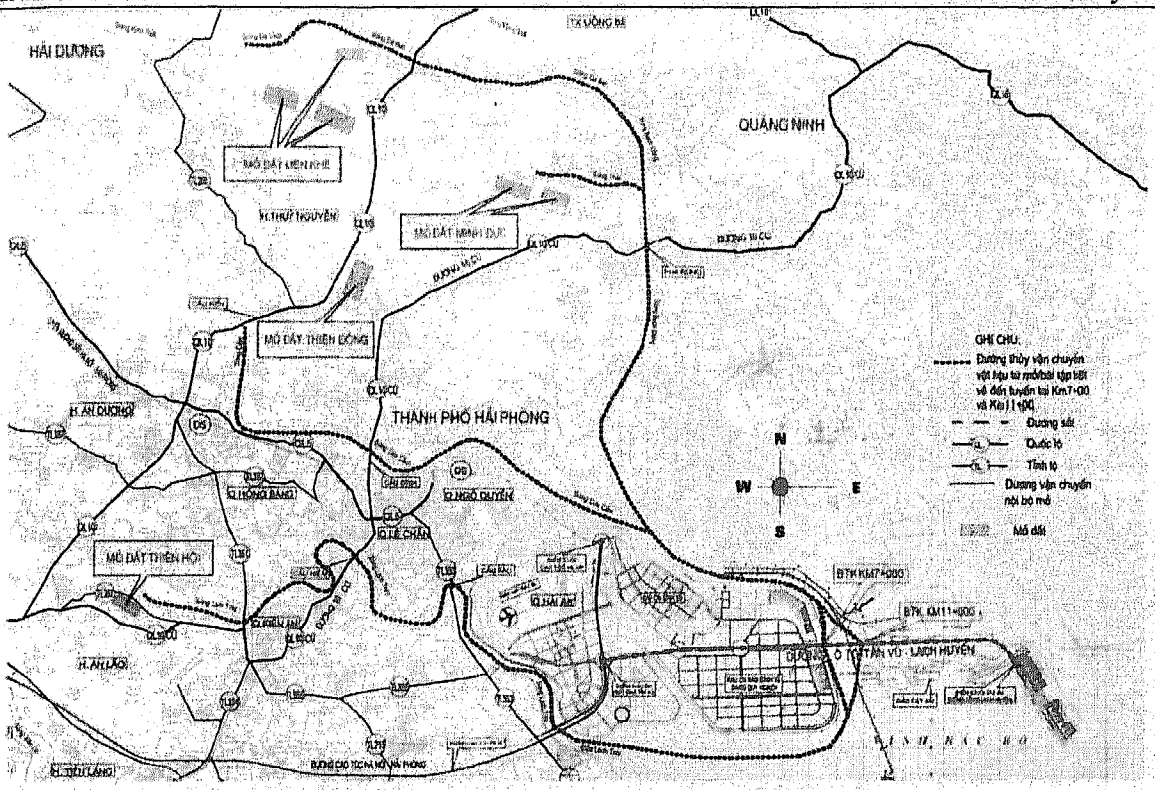
Source: Study Team

In the above table, the steel pipe sheet pile is produced only in Japan, therefore, it is assumed to be imported from Japan. Regarding the steel pile, said material could either be procured in Vietnam or imported from Japan.

(3) ***Embankment Materials***

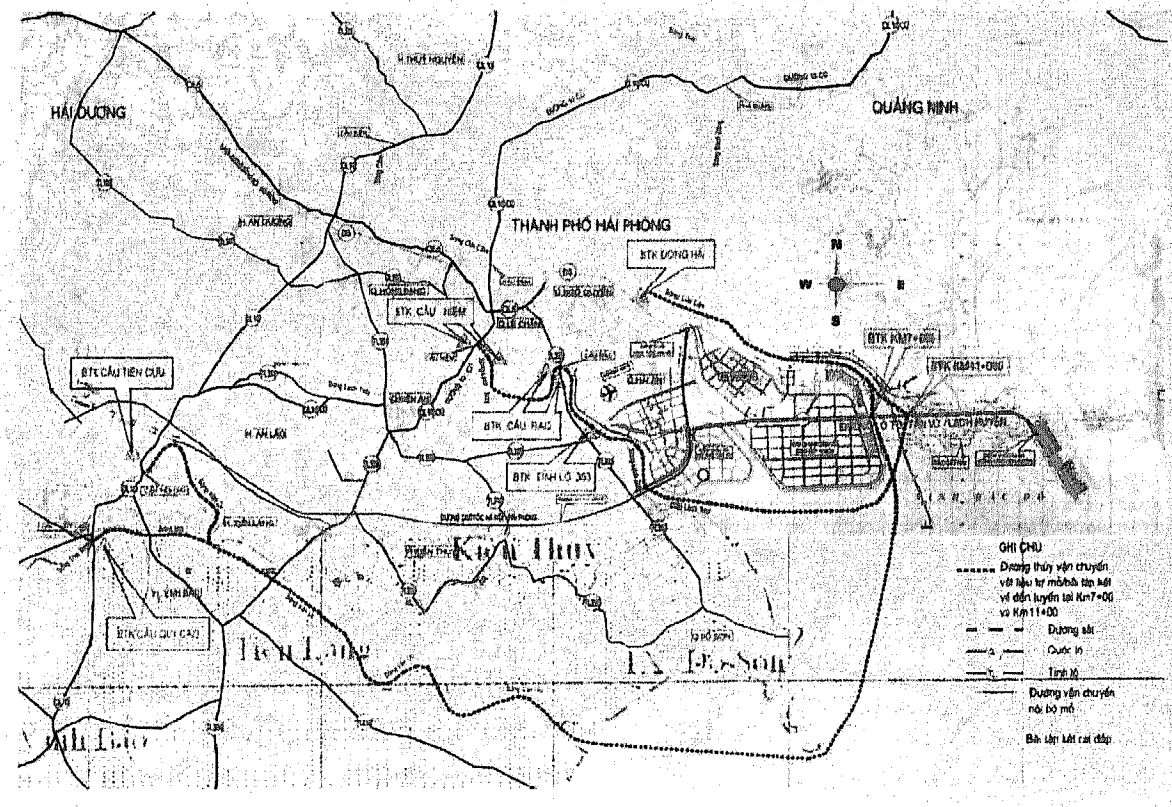
Embankment materials, borrow pits for soil and sand, and stone quarries, which have a huge volume, are estimated with reference to that of the F/S report.

Figures 2.6-3 to 2.6-5 show the locations of the borrow pits while Figures 2.6-6 and 2.6-7 show the potential borrow pits for each material. Tables-1 to 3 present the source and transport distance of borrow materials.



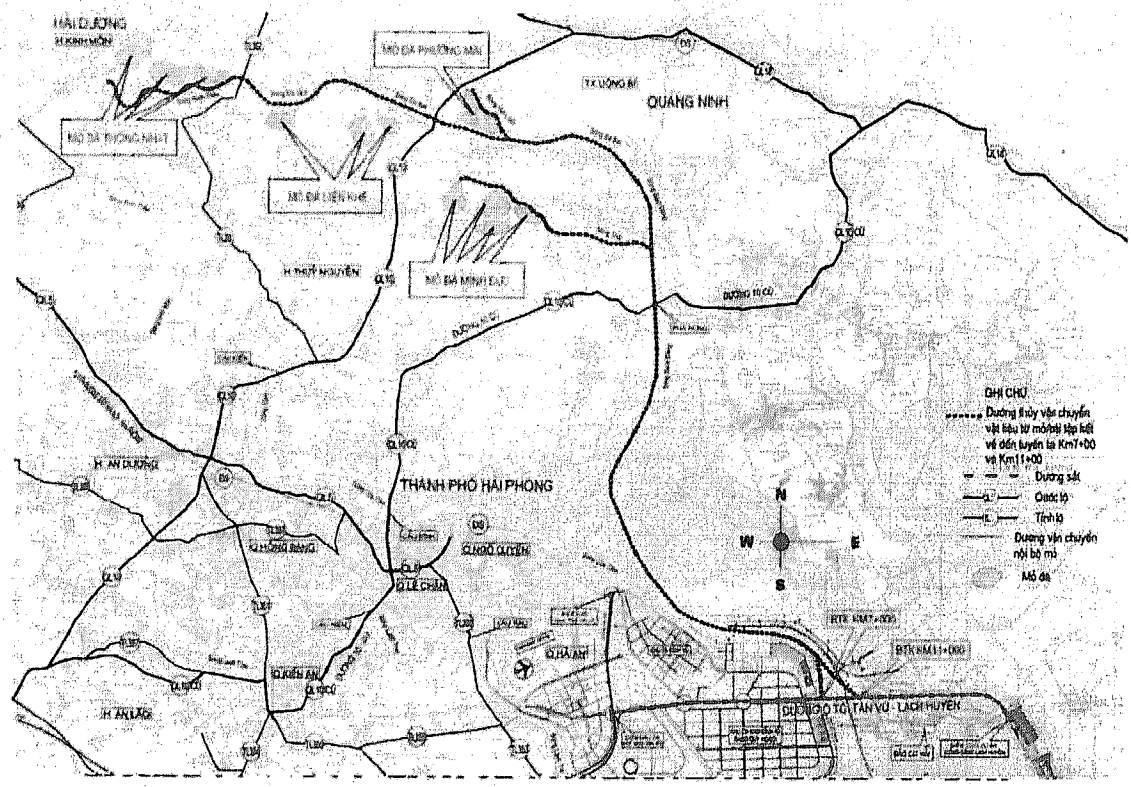
Source: F/S Report (July 2009)

Figure 2.6-3 Location of Borrow Pits (Sand)



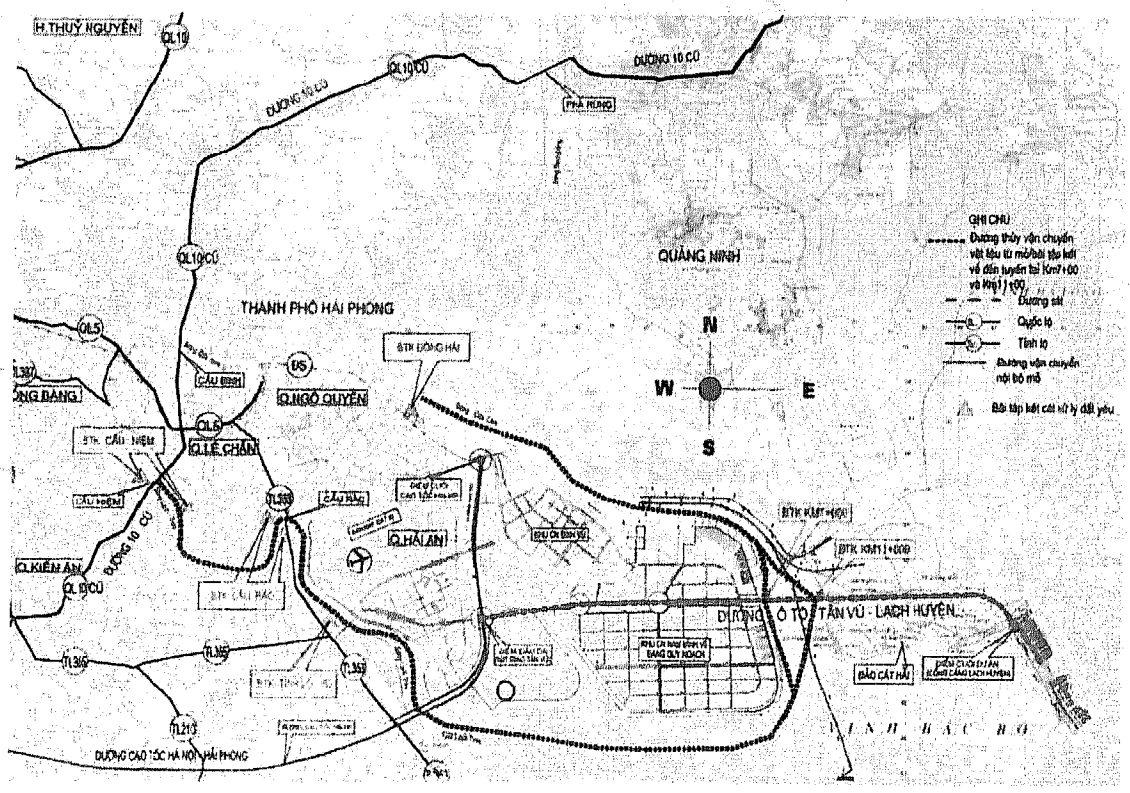
Source: F/S Report (July 2009)

Figure 2.6-4 Location of Borrow Pits (Sand)



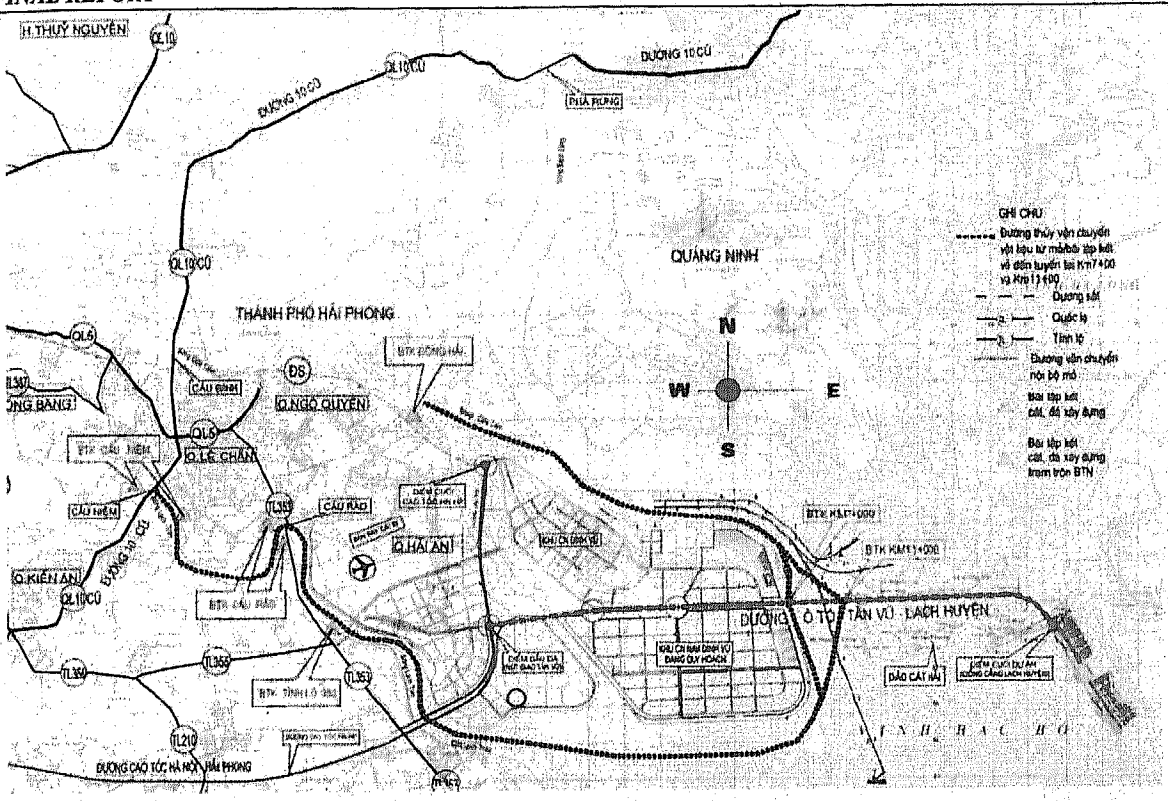
Source: F/S Report (July 2009)

Figure 2.6-5 Location of Stone Quarries



Source: F/S Report (July 2009)

Figure 2.6-6 Location of Borrow Pits (Sand for Soft Ground Treatment)



Source: F/S Report (July 2009)

Figure 2.6-7 Sand and Construction Stone Yards

Table 2.6-3 Means and Transport Distance of the Borrow Materials

Items	Material Pits / Yards							
	Location of Pits / Yards	Material Sources	Capacity (m3)	Capability Supply	Route from Pits/Yards to Location of the Project	Transport distance		
						Road(km)	Waterway (km)	Total (km)
Fine sand for embanking foundation	Yards along Provincial Road No.353	Sand on Thai Binh River and Kinh Thay River	Capacity of fine sand on Kinh Thay river, Van Uc river and Thai Binh river are very huge	4000 m3/day	From material Yards to points to declare on route , station Km7+00 and Km 11+00	0	20.2	20.2
	Yards near Rao Bridge			2000 m3/day		0	22.4	22.4
	Yards near Niem Bridge			1500 m3/day		0	28.7	28.7
	Dong Hai Yard			1000 m3/day		0	13.7	13.7
	Yards near Tien Cuu Bridge	Sand on Kinh Thay River		3000 m3/day		0	56.2	56.2
	Yards near Quy Cao Bridge	Sand on Van Uc River		2000 m3/day		0	54.8	54.8
Embankment soil K98	Lien Khe Soil Pit		500,000	2000 m3/day		1.0 (Soil road)	38.8	39.8
	Minh Duc soil pit		800,000	3000 m3/day		1.5 (Soil road)	27.6	29.1
	Thien Hoi soil pit		50,000	1000 m3/day		1.5 (Soil road)	40.8	42.3
Embankment soil K95 to protect sloop	Thien Dong soil pit		400,000	2000 m3/day	From material Yards to points to declare on route , station Km7+00 and Km 11+00	4.5 (Asphalt road)	3.8	35.3

Items	Material Pits / Yards								
	Location of Pits / Yards	Location of Pits / Yards	Location of Pits / Yards	Location of Pits / Yards	Location of Pits / Yards	Location of Pits / Yards	Transport distance		
							Road (km)	Road (km)	Road (km)
Bedding sand and sand pile for soft embank-ment	Yards along Provincial Road No.353	Sand sources Lo River, Viet Tri - Phu Tho		1500 m3/day		From material Yards to points to declare on route , station Km7+00 and Km 11+00	0	20.2	20.2
	Yards near Rao Bridge			2000 m3/day			0	22.4	22.4
	Yards near Niem Bridge			500 M3/day			0	28.7	28.7
	Dong Hai Yard			500 m3/day			0	13.7	13.7
	Sand sources on Lo River, in Viet Tri - Phu Tho						0	272	272

Source: F/S Report (July 2009)

Table 2.6-4 Means for Transporting Materials and Transport Distance

Item	Material pits / Yards					Transport distance		
	Location of material pit/Yard	Material source	Available Volume (m3)	Available Capacity	Road conditions from pits / Yards to the site	Road (km)	Waterway (km)	Total (km)
Fine aggregate (stone 0x5mm) and coarse aggregate for AC concrete, coarse aggregate for CC, Base, and Sub-base	Thong Nhat Stone Quarry	Limestone	Very huge	6,000 m3/day	From Yards to start point, station Km7+00 and Km11+00	1.5 (Soil road)	47.0	48.5
	Phuong Mai Stone Quarry		Very huge	1,000 m3/day		0.5 (Soil road)	34.0	34.5
	Minh Duc Stone Quarry		Very huge	2,000 m3/day		0.5 (Soil road)	29.4	29.9
	Lien Khe Stone Quarry		Very huge	1,500 m3/day		0.5 (Soil road)	36.4	36.9
Fine aggregate for AC and for CC (coarse sand)	Yard on provincial road 353	Sand pit Lo river, Viet Tri - Phu Tho		500 m3/day	From pits/Yards to start point, station Km7+00 and Km11+00	0	20.2	20.2
	Yard near Rao bridge			700 m3/day		0	22.4	22.4
	Yard near Niem bridge			300 m3/day		0	28.7	28.7
	Yard near Dong Hai bridge			300 m3/day		0	13.7	13.7
	Sand pit Lo river, Viet Tri - Phu Tho			1,000,000 m3/year		0	272	272

Source: F/S Report (July 2009)

Table 2.6-5 Location and Transport Distance from Material Pits/Yards to Project Site

(Establishing Yards toward Hai Nam at station Km7+00 and toward Cat Hai at station Km11+00)

Pit / Yard	Unit	Road	Waterway		Total
1. Thong Nhat Stone Quarry Phu Thu Town - Kinh Mon - Hai Duong	km	*1.5* Soil road	*47.0* Kinh Thay River Da Vach River Da Bac River Bach Dang River Nam Trieu River Mouth	 3.3 4.9 11.6 17.2 10.0	48.5
2. Phuong Mai Stone Quarry Phuong Nam Commune - Uong Bi - Quang Ninh	km	*0.5* Soil road	*34.0* Hang Ma River Da Bac River Bach Dang River Nam Trieu River Mouth	 3.2 3.6 17.2 10.0	34.5
3. Lien Khe Stone Quarry Lien Khe Commune - Thuy Nguyen – Hai Phong	km	*0.5* Soil road	*36.4* Da Bac River Bach Dang River Nam Trieu River Mouth	 9.2 17.2 10.0	36.9
4. Minh Duc Stone Quarry Minh Duc Town - Thuy Nguyen - Hai Phong	km	*0.5* Soil road	*29.4* Thai River Bach Dang River Nam Trieu River Mouth	 6.0 13.4 10.0	29.9
5. Soil Pit Lien Khe Lien Khe Commune - Thuy Nguyen - Hai Phong	km	*1.0* Soil road	*38.8* Da Bac River Bach Dang River Nam Trieu River Mouth	 11.6 17.2 10.0	39.8
6. Minh Duc Soil Pit Minh Duc Town - Thuy Nguyen - Hai Phong	km	*1.5* Soil road	*27.6* River Thai Bach Dang River Nam Trieu River Mouth	 4.2 13.4 10.0	29.1
7. Thien Dong Soil Pit Dong Son Commune - Thuy Nguyen - Hai Phong	km	*4.5* Asphalt road (NH10 before)	*30.8* River Cam Cam River Mouth Nam Trieu River Mouth	 3.9 16.9 10.0	35.3
8. Thien Hoi Soil Pit An Tien Commune - An Lao -Hai Phong	km	*1.5* Soil road	*40.8* Lach Tray River Lach Tray River Mouth Sea	 25.9 3.3 11.6	42.3
9. Yard near Quy Cao Bridge Giang Bien Commune - Vinh Bao - Hai Phong	km	*0.0*	*54.8* Thai Binh River Van Uc River Sea	 6.0 22.7 26.1	54.8
Pit / Yard	Unit	Road	Waterway		Total
10. Yard near Tien Cuu Bridge Quang Trung Commune - An Lao - Hai Phong	km	*0.0*	*56.2* Van Uc River Sea	 30.1 26.1	56.2
11. Yard near Niem Bridge Vinh Niem Ward - Le Chan and Quan Tru Ward - Kien An	km	*0.0*	*28.7* Lach Tray River Lach Tray River Mouth	 13.8 3.3	28.7
- Hai Phong			Sea	11.6	
12. Yard near Rao Bridge Dang Giang Ward - Ngo Quyen and Anh Dung Ward - Duong Kinh - Hai Phong	km	*0.0*	*22.4* Lach Tray River Lach Tray River Mouth Sea	 7.5 3.3 11.6	22.4
13. Yard in provincial road No. 353 Anh Dung Ward - Duong Kinh - Hai Phong	km	*0.0*	*20.2* Lach Tray River Lach Tray River Mouth Sea	 5.3 3.3 11.6	20.2
14. Dong Hai Yard Dong Hai Ward - Hai An - Hai Phong	km	*0.0*	*13.7* Cua Cam River Nam Trieu River Mouth	 3.7 10.0	13.7
15. Asphalt Mixing plant - Yard in provincial road No. 353 Anh Dung Ward - Duong Kinh - Hai Phong	Km	*11.3* Asphalt road 9.9 km Soil road 1.4 km			11.3 (transport to Km0)
16. Asphalt Mixing plant - Yard near Rao Bridge Anh Dung Ward - Duong Kinh - Hai Phong	Km	*13.5* Asphalt road 12.1 km Soil road 1.4 km			13.5 (transport to Km0)

Source: F/S Report (July 2009)